

Claims

[c1] A method of performing chemical-mechanical polishing (CMP) on a workpiece using a CMP apparatus and an endpoint detection apparatus, the CMP apparatus performing polishing on the workpiece using a slurry, the method comprising the steps of:

providing a slurry sampling tube for conducting slurry from the CMP apparatus to the endpoint detection apparatus;

providing a slurry flushing apparatus for flushing slurry from the sampling tube;

pumping slurry through the sampling tube in a slurry flow direction from the CMP apparatus into the endpoint detection apparatus while a polishing operation is in progress; and

flushing the sampling tube while a polishing operation is not in progress,

wherein said flushing is commenced in accordance with a control signal from the endpoint detection apparatus terminating the polishing operation, and said flushing is terminated in accordance with a starting signal for a next polishing operation.

- [c2] A method according to claim 1, wherein said flushing apparatus comprises a first flow control valve, and said flushing step further comprises opening the first flow control valve to commence said flushing when the polishing operation is terminated, and closing the first flow control valve to terminate said flushing when the next polishing operation is commenced.
- [c3] A method according to claim 2, wherein the flushing apparatus further comprises a second flow control valve for controlling a flow of water to the first control valve, and during said flushing step a first portion of said flow is pumped into the endpoint detection apparatus while a second portion of said flow flushes the sampling tube in a flushing direction opposite said slurry flow direction.
- [c4] A method according to claim 3, wherein the second flow control valve is a needle valve.
- [c5] A method according to claim 3, wherein the endpoint detection apparatus has a maximum fluid intake rate, and further comprising the step of adjusting the second flow control valve so that said flow of water exceeds said maximum fluid intake rate, the first portion of said flow being equal to said maximum fluid intake rate.

- [c6] A method according to claim 1, wherein the sampling tube is connected to a slurry collector for collecting slurry from the CMP apparatus during the polishing operation, and said flushing step further comprises flushing the slurry collector while the polishing operation is not in progress.
- [c7] A method according to claim 2, wherein the first flow control valve is characterized as normally-open/active-closed, so that said valve is closed by an electrical signal in response to an electrical starting signal for starting a polishing operation.
- [c8] A method according to claim 1, further comprising the step of:
detecting the endpoint of the polishing operation by analyzing the slurry pumped into the endpoint detection apparatus in said pumping step, said detecting being performed using an inductively coupled plasma (ICP) and atomic emission spectroscopy (AES).
- [c9] A method according to claim 1, further comprising the step of pumping water into the endpoint detection apparatus while the polishing operation is not in progress.
- [c10] A method according to claim 9, wherein said pumping steps are performed by a peristaltic pump which contin-

uously pumps at least one of slurry and water.

- [c11] A chemical-mechanical polishing (CMP) system for performing a polishing operation on a workpiece, the polishing operation being performed using a slurry in a CMP apparatus, the polishing operation being controlled in accordance with analysis of a sample of slurry in an endpoint detection apparatus, the system comprising:
 - a slurry transport and flushing apparatus including a slurry collector for collecting slurry from the CMP apparatus during the polishing operation,
 - a slurry sampling tube connecting the slurry collector and the endpoint detection apparatus,
 - a first flow control valve, connected to said slurry sampling tube, for controlling a flow of water into said slurry sampling tube to flush slurry from said sampling tube while the polishing operation is not in progress, and
 - a second flow control valve, connected to said first control valve by a flushing tube, for controlling the flow of water to said first control valve;
- wherein
 - the endpoint detection apparatus includes a pump for pumping slurry through said slurry sampling tube during the polishing operation,
 - the flow of water is effective to flush said sampling tube, said first flow control valve is opened when the polishing

operation is terminated in accordance with an endpoint signal from the endpoint detection apparatus, and said first flow control valve is closed when a next polishing operation is commenced in accordance with a starting signal.

- [c12] A CMP system according to claim 11, wherein said second flow control valve is a needle valve.
- [c13] A CMP system according to claim 11, wherein during the polishing operation said pump pumps slurry in a slurry flow direction from the slurry collector into the endpoint detection apparatus, and while the polishing operation is not in progress said pump pumps a first portion of said flow of water into the endpoint detection apparatus while a second portion of said flow of water flushes the sampling tube in a flushing direction opposite said slurry flow direction.
- [c14] A CMP system according to claim 13, wherein the endpoint detection apparatus has a maximum fluid intake rate, and said second flow control valve is adjusted so that said flow of water exceeds said maximum fluid intake rate, the first portion of said flow being equal to said maximum fluid intake rate.
- [c15] A CMP system according to claim 11, wherein the flow of

water is effective to flush the slurry collector while the polishing operation is not in progress.

- [c16] A CMP system according to claim 11, wherein the first flow control valve is characterized as normally-open/active-closed, so that said valve is closed by an electrical signal in response to an electrical starting signal for starting a polishing operation.
- [c17] A CMP system according to claim 11, further comprising the endpoint detection apparatus, said apparatus including an inductively coupled plasma (ICP) chamber and an atomic emission spectroscopy (AES) unit.
- [c18] A CMP system according to claim 13, wherein said pump is a peristaltic pump which continuously pumps at least one of slurry and water.